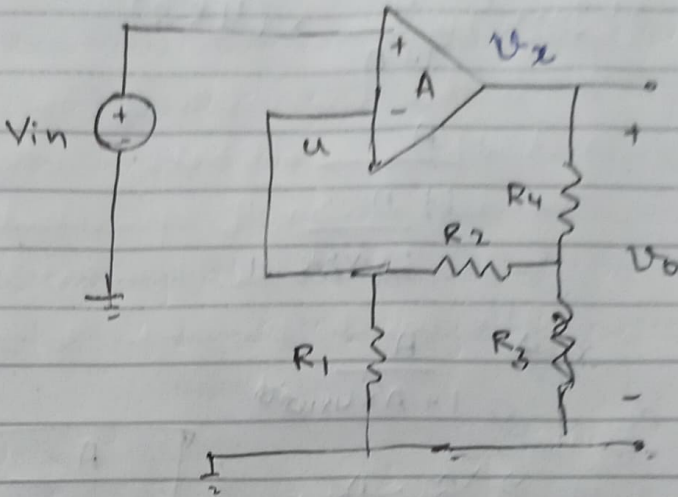1. For the circuit shown below,



i) Find the expression for feedback factor $k$ and closed loop voltage gain

$$v_x = (V_{in} - u) A.$$

$$u = R_1/R_1 + R_2 \times \frac{R_3}{R_3 + R_4} + 1$$

2) $$K = \frac{R_1 \times R_3}{(R_1 + R_2)(R_3 + R_4)}, \quad *$$

$$CL \, gain = \frac{A}{1 + AK} + 1$$

2) $$\frac{A}{1 + A R_1 R_3 + (R_1 + R_2)(R_3 + R_4)} \times \frac{(R_1 + R_2)(R_3 + R_4)}{}$$

$$= \frac{A}{1 + \frac{A R_1 R_3}{(R_1 + R_2)(R_3 + R_4)}} + 1$$

ii) CL if $R_1 = R_2 = R_3 = R_4 = 1k\Omega$.

$\Rightarrow$ $C_L$ gain $= \dfrac{A}{1+A} \times (4\kappa\Omega)$.

$= \dfrac{A}{1+\dfrac{A}{2\kappa \times 2k\Omega.4}}$

$\Rightarrow \dfrac{A}{1 + A \times 4 \times 10^{-6}}$

$\Rightarrow \simeq A_{11}$. $= \boxed{\dfrac{A}{1+ A/4} + 1}$.

iii) if $A = 200 \, V \times V$

$C_L$ gain $= \dfrac{200}{1 + 200 \times \text{...}}$

$= \dfrac{200}{1 + 200/4}$

$= \dfrac{200}{1.008 \, 1 + 50}$

$\simeq \text{...} \simeq 4+1 \simeq \boxed{5}$.

$\dfrac{A}{1+AK} = 0.2$

$K = 0.2$

3. Write a short note on slew rate, PSRR and offset effects in opamps.

### Slew rate:

The slew rate of an electronic circuit is defined as the rate of change of the voltage per unit time. Slew rate is usually expressed in units of V/μs.

$$SR = max \left| \frac{d\,Vout\,(t)}{dt} \right|$$

where Vout (t) is the output produced by the amplifier as a function of time t.

### PSRR:

Power Supply Rejection Ratio (PSRR) can be reffered either to the output (RTO) or the input (RTI). The RTI value can be obtained by dividing the RTO value by the amplifier gain. In the case of the traditional op-amp, this would be the noise gain. ~~that~~ ~~datra sheet~~

### OFFSET:

May be due to error occured during fabrication and finite gain of the opamp. It is due to the inherent mismatch of the input transista and components during fabrication.

4. Write a short note on noise bandwidth & Noise figure.

## Noise bandwidth:

It is the bandwidth of an ideal rectangular amplifier. In other words the definition of equivalent noise bandwidth is the bandwidth of a given filter which produces the same noise.

## Noise figure:

It is used to indicate the quality of amplifier. There are various methods used to measure noise figure.

    i) Gain Method
    ii) Y factor method.
    iii) Noise figure meter method.

;.ac dec 1000 1m 1G
.tran 0 1m 0 1u

VCC
15V

U2
LT6016

VEE
15V

Vin
SINE(0 1 10k)
AC 1 0

vout

R3
1K

R5
1K

R6
1K

R4
1K